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ABSTRACT

This paper presents an overview of the emerging information resources management (IRM) concept and suggests reasons why IRM would be a useful framework for educational institutions. An introductory look at current information problems precedes a review of definitions of information and IRM in the literature, and a definition of IRM as used in this paper. There is a brief examination of the roots of IRM in libraries, information centers, and computer and telecommunications technologies. The human uses of information in the decision-making process are considered. A review of information processing in hierarchical organizations identifies approaches which either reduce the causes of information expansion or increase the organization's capacity to deal with greater amounts of information. Costs and benefits of each method and various roles and functions of information resource managers within organizations are discussed. Examples are drawn from both educational and business environments. The paper concludes with a list of 33 references, and a 35-item ERIC bibliography divided into sections covering the historical antecedents of IRM, the impact of information systems on education, assessments of information needs within education, specific applications of information technology in educational institutions, and other ERIC documents on information management. An ERIC author index is provided. (ESR)

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# INFORMATION RESOURCES MANAGEMENT:

# AN OVERVIEW FOR EDUCATORS

by

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ERIC Clearinghouse on Information Resources
Syracuse University
1981



IR-58

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## Foreword

Samuel Johnson defined two types of knowledge: facts which we learn directly by ourselves and procedures which lead us to the information source. Education has been concerned primarily with the former, while information science has dealt with the latter.

Information overload is a condition described by many professionals who have to consider and handle more data and new ideas than ever before in human history. It is obvious that no individual in any organization can be the fountainhead of all information. Yet, vast amounts of new information are generated daily and it is meant to be used.

The computer has been the right instrument in the right place at the right time. Even though microchip technology has been responsible for generating more data, it also is able to store and handle those data for future use. The information overload problem has been a natural for a computer solution. One of the spinoffs of this linkage has been the emerging field of information resources management (IRM).

IRM first developed in the business and military sectors when information began to be perceived as a valuable commodity. The ability to systematically store and almost instantly retrieve information needed to help make corporate decisions was too attractive to neglect, even at relatively high equipment investment costs. The use of information from such systems soon proved to be well worth the investment and other organizations began to consider new information handling systems.

Since education has been one of the last institutions to recognize the value of information resources management to help bridge the gap between the traditional, labor-intensive manual filing and contemporary data handling technology, the ERIC Clearinghouse on Information Resources commissioned this monograph. It provides a conceptual scheme which could be generic for any organization, and then relates the general scheme to the context of education. Educational examples are used extensively. A special ERIC bibliography is also included.

Dr. Evelyn H. Daniel has pioneered the program in Information Resources Management in the School of Information Studies at Syracuse University. She has taught in this area and in school media librarianship. The product of her effort draws on this background and a background in professional education. The result is a monograph which should be useful to those who contemplating next steps in IRM within the schools.

Donald P. Ely
Director, ERIC/IR

## The Problem

You can't push something which is moving faster than you are.
A principle of Newtonian physics.

The amount of data that we collect and store routinely today would have been inconceivable at the turn of the century. Consider, for example, the billions of bits of data involved in collecting and storing records on fingerprints, income taxes, social security, space explorations, credit card transactions, community and industrial environmental pollution data, meteorological readings, student information, and so forth. We are now annually receiving 1,000 trillion data bits from NASA satellites and probes, of which some 10 terabits ($10 \times 10^{12}$ coded pieces of information) will be added to storage. One terabit of information, at 800 bits per punched card stored in boxes of 2,000 cards, will fill a string of boxes 123 miles long (Maugh, 1978).

Within any local school system, huge amounts of data are on file concerning students (their changing total numbers, grade levels, socio-economic status and other demographics, IQs, grade point averages, disciplinary information, classes taken, sports participation, and many other items--most of them both current and historical). There is also an equal amount of data on faculty, the curriculum, the budget and expenditures (present and historical by an ever-increasing number of categories), the physical plant, equipment owned and leased, insurance records, instructional materials, state and local policies, and many, many more individual data items, both textual and numeric, which are stored in hand-written reports and machine-readable forms.

The number of information storage devices within educational and other institutions has grown phenomenally to keep pace with the collection and storage of more and more data about more and more aspects of the school's operations. It has been estimated that in 1980 the information storage business exceeded $2 billion (Maugh, 1978). More and more people are involved in processing data and attempting to reduce it to information. In 1890 we were an agricultural society. Forty-six percent of the work force was employed in agriculture. Only 4 percent could be considered to be in the information handling

business. By 1980 these statistics had been reversed. There are now only 4 percent of our workforce employed in agriculture while there are more than 46 percent working in various aspects of information service provision (Porat, 1981).

Another major response to (some might say, cause of) this proliferation of data has been the development of increasingly sophisticated information handling technology. Computers have become smaller, faster, more able, more reliable, and cheaper. If one converts the approximately 20 million books in the Library of Congress into an estimated 70 trillion bits of data, a large IBM mainframe computer today might be able to hold a twentieth of the total (Branscomb, 1979). The expectation is that newer technologies will continue to increase storage capacity. Input and output devices are also undergoing major changes. Voice recognition, word pattern recognition, non-impact printer technologies using ink jet printing, and printing by laser electrophotography are already available experimentally. There is an expectation that the various information carriers, such as books, video, film, telephones, radio, records and tapes, will become interrelated and interchangeable. Given the rate of technological growth, Branscomb considers that it may be cheaper in the next century to reconstitute or reacquire information from basic data elements each time rather than to store it (Branscomb, 1979).

Communications technology has also expanded. Laser technology can now carry 800 simultaneous conversations through a single hair-thin optical fiber. This, translated into data bits, equals a transmission rate of some 40,000 books per hour. Soon we may be able to transfer data equivalent to a billion books per second. Lightwave communication could well do away with the need for wire connections between terminals. The marriage of the computer and the communication technologies has created nearly infinite possibilities for data collection, storage, and transmission.

However, having data is quite different from being able to assimilate it and use it in human decision-making processes. It is helpful to make a distinction between data (sometimes referred to as information resources) and information itself, which inheres in people and is a volatile concept. We all know that what information is for me may not be for you and vice versa. We know that what is information today may not be tomorrow. Information is time, event, and person dependent. It has no separate objective reality.

One of the biggest problems today seems to be that the capabilities of the information technology have surpassed our human abilities to use effectively and efficiently the data which have been collected and stored. Herbert Simon refers to this problem as one of "attention management." He points out that, "The scarce resource is not information; it is the processing capacity to attend to information" (Simon, 1973). Many recent studies have demonstrated that people have a limited information processing capacity. For example, our perception of information is selective rather than comprehensive. Perhaps about 1/70th of what is present in the visual field can be perceived at one time (Neisser, 1976). We process information sequentially as we are limited in our ability to integrate a great deal of information simultaneously (Anderson, 1980). As our capacity is limited, we use fairly simple procedures, rules, or heuristics in processing information in order to reduce the mental effort involved. People also have limited memory capacities. George Miller used the term "chunk" to describe units of memory and demonstrated that people can remember only about seven chunks (letters, words, meaningful phrases, etc.) (Miller, 1956). Sherlock Holmes gives us a more valid picture of this idea:

> "I consider that a man's brain originally is like an empty attic, and you have to stock it with such furniture as you choose . . . . It is of the highest importance not to have useless facts elbowing out the useful ones." (Doyle, 1976)

Thus, we have on the one hand innovative technology-based techniques creating a proliferation of, and growing dependency on, information products and services, and on the other hand, the increasing volume of available information creating serious problems for the information-processing capacities of those who manage. It is clear that the complex requirements of an information society have made traditional management approaches for handling information increasingly ineffectual.

Historically, information management has been a fragmented activity, shared among the traditionally independent elements of an organization. Organizations have typically separated various kinds of information--financial, personnel, market factors, production control, government regulations, and the like. At the operating level, each department has its own information system. Many of the critical data handling activities of an organization, for example, payroll,

invoices, inventories, and the like, have been located in the administrative, financial management, or business office. Automation of these activities has resulted in placing management responsibilities for computers and information systems in the office of the organization's administrator or comptroller. After information flows up the organization it becomes converted into a monetary symbol system for conceptual ease of top management in trying to interpret the health of the firm as a whole. Although these quantitative monetary measures are considered to be the primary information carriers, the extremes of inflationary pressures may have made these symbolic monetary conversions less useful as stable and meaningful measures.

Other information related programs may be administered by other elements in an organization. For example, information and library services, statistical data collection and analysis, public information programs, and associated activities that may exist separately may not be centrally managed. The most common pattern in organization is that there are many such information resources all of which have similar processes, that is, each of these information elements collects data, organizes it into meaningful categories, stores it, retrieves it, and reports it periodically in some summarized and interpreted fashion.

The same abilities and skills underlie the creation of an information system that manages the payroll and one that deals with pupil personnel information, or one that focuses on the provision of career information. A quick search of ERIC for the past three years turned up an amazing array of discrete educational information systems (see appendix for bibliography). There were descriptions of systems for property records, the design of inservice programs, financial records, the supply and demand for teachers, evaluation of special education, human resources, occupational education, handicapped children, Indian education, career information, curriculum management, administrator evaluation, many systems for pupil information, and a plethora of others. Although responsibility for managing these myriad activities and services dealing with information resources is often shared, in many cases the jurisdictional responsibility for the maintenance and use of these systems is not clear. As a result of this fragmented approach, information resources sometimes have been poorly managed and inadequately used and a non-rationalized information management structure has resulted.

As technologies merge, the requirement to examine all aspects of information handling as a cohesive whole becomes critical. The lack of comprehensive management structures affects systems development and the integration of existing information resources. In an effort to improve information resources management, some organizations have explored various information management approaches and have attempted to pinpoint responsibility and establish special controls for coordinating information activities and services.

Within information resources management, an emerging concept is that of the corporate database, which assumes that data which are essential for management must be shared throughout the organization, that the data must be consistent and accurate, and that they must be available for rapid response to a variety of queries from a variety of effective points in the organization. This concept has led to the development of database management systems and the development of data dictionaries and data directories which carefully define all the elements in the database so that there is consistency and standardization in the way terms are used. Database management systems have been made possible by the increased storage capacity of computers and the increasingly sophisticated programming software.

Information resources management deals with the rationalization of these separate information handling systems and goes further, exercising responsibility and concern for the consumption of information in the best way possible for the organization.

It is the thesis of this paper that the information resources management function is crucial to the efficiency and effectiveness of today's large organizations. This is as true of large school systems as it is of public utilities, government agencies, and private corporations. This paper is an attempt to produce an overview of the emerging information resources management (IRM) concept and to suggest reasons why it may be a useful framework for educational institutions to adopt. Following a brief definition and summary of the historical antecedents of the IRM idea, some of the key concepts will be described. Arguments will be presented to show why the IRM activity is so vitally important today and why it may be beneficial to recognize IRM formally within the organization structure. The remainder of the paper will describe various ways in which the IRM

function can be handled organizationally, discussing some of the benefits and costs of each configuration and the various roles and functions of information resource managers.

> It is not so much a problem of data acquisition as of data organization; not so much of organization as of retrieval; not so much of retrieval as of proper choice; not so much of proper choice as of identification of wants; not so much of identification of wants as of identification of needs. Obviously the problem in information management is not one of gathering, organizing, storing, or retrieving data but rather one of determining the necessary information requirements for decision making. -- Schoderbek, et al.

In the introduction to this paper, care was taken to refer to the collection and storage of data rather than information, and the point was made that information inheres in people. The distinction between data (or information resources) and information is an important one and may bear further elaboration. Data are isolated facts; information implies the existence of usefulness. One author calls information "meaningful bits of data being transmitted" (Knight and McDaniel, 1979). Others speak of information as "evaluated data," or of "structured data." It may be helpful to think of data being reduced to information; there is always less information than there is data. Data are symbols, objects, or physical phenomena (such as light and sound) that have the potential for making an impression on the environment. Information connotes organization and readiness for application. It adds meaning to otherwise only potentially useful data. Fox, looking at information from a philosophical point of view and trying to define it ontologically, concludes that information is propositions, that is, assertions about the world. He notes that information need not be true. (However, misinformation must be false.) He further argues that the role of the human agent in the transfer and conveyance of information is crucial (Fox, 1982).

Data can be generated indefinitely--stored, retrieved, updated, and filed--in part, perhaps, because we have information technologies that make it relatively easy, and in part due to the erroneous assumption that data are information. Each year the cost of data acquisition and storage grows as we store more and more bits of data and then attempt to analyze it and reduce it to information. Data overload is a major problem. We more commonly speak of information overload, but the term is inaccurate. We lack organized,

structured data in the right form (that is, information) to apply to particular problems at the appropriate time.

Information has some peculiar properties when we consider it apart from the data that contain it. As was pointed out earlier, what constitutes information for one individual in a specific instance may not do so for another, or may not do so for the same individual at a different time or for a different problem. Information useful for one manager may turn out to be totally devoid of value for another. Information is an important resource but often behaves differently from the traditional resources of people, buildings, and material. It can be used without being used up. Where data have an objective life, information has no reality outside of human actors.

People have different ideas about information. When a group of managers from several middle-sized American companies were asked what information meant to them, they responded as follows:

- Information is a piece of knowledge.
- Information is an idea, opinions, feelings, or fact.
- Information is something that precedes action.
- Information is something that has the quality of being true or false, correct or incorrect, timely or untimely, relevant or irrelevant, or vague or precise.
- Information is something that helps eliminate 'second guessing.'
- Information is a unit of something to which humans assign meaning.
- Information is something that stands by itself.
- Information is a means by which humans and machines exert control over themselves and their environment. (Goldhaber, et al., 1979)

Some of these definitions stress the notion that information is a physical thing; others see it as an important part of a process; still others see it as an abstraction or as a tautology. Drucker says that "information is logic . . . purely formal . . . impersonal rather than interpersonal" (Drucker, 1973). He goes on to assert that the more information can be freed of the emotions and values that humans

bring to it the more valid and reliable it becomes. That may be a rational fallacy as the emotions and values may also be useful bits of information, but it does demonstrate that information is an elusive and difficult concept. We think of it as both an abstraction (ideas) and as a physical commodity (data).

Simon, among others, finds it helpful to distinguish among knowledge, information, and fact. Facts and data answer four of the six interrogative questions--what, who, when and where; information answers the how and why; knowledge is an organized body of information (Simon, 1959). Berry and Cook extend this further in attempting to develop a theory of knowledge. They divide knowledge into three main classes that roughly correspond to data, information, and knowledge. Factual knowledge can be data (raw, unevaluated facts) or metadata (data about the relationships among other data). Procedural knowledge may be algorithmic (routine decision rules and standard operating procedures) or heuristic (discovery oriented). Judgmental knowledge may fall into the category of constraints (laws, rules, policies) or goals (the direction in which the organization is moving) (Berry and Cook, 1976).

Information resources management as a concept, then, seems to beg the question of whether information is a physical resource or a proposition understandable only by people and only at a particular place and a particular time. This author chooses to define the concept broadly enough to include both aspects. Certainly all we know about resources management of such things as supplies, money, and equipment, can be usefully applied to the management of data or information resources. As other resources are acquired, stored, delivered, and controlled, so information resources (data) as embodied in statistics, reports, books, and journals, whether in print, machine-readable or other non-print format, can also be acquired, stored, delivered and controlled in much the same way. So even though the management of information may be less straightforward than that of other kinds of physical resources, considering only the physical carriers of information, the general principles of resources management can apply.

Horton reminds us of the assumptions underlying the management of any basic resource (Horton, 1980). These are that the resource must be understood. We need to appreciate the uses, limitations, and opportunities for the use of this resource in relation

to all the other resources of the organization. The resource must also be acquired wisely; no resource is free. It must be conserved to avoid waste, abuse, and misuse. It must be exploited fully to maximize its uses and applications.

Thus the objectives of all effective resource management are (1) to maximize the value of the resource toward achieving the organizations' goals; (2) to minimize the cost of acquiring, processing, storing, using and disposing of it; and (3) to fix the accountability for its efficient and effective use in one or more individuals or in an organizational unit with named responsibility.

The following list, taken from Horton, shows how he sees the relationships between the particular kinds of resources and the corporate management category:

| | |
|---|---|
| Money and Capital | Financial Management |
| Human Resources | Personnel Management |
| Land and Buildings | Space Management |
| Material and Equipment | Supply and Inventory Management |
| Ideas and Knowledge | Research and Development Management |
| Information and Paper Work (Data and Facts) | Information Resources Management (Horton, 1980) |

Given this brief discussion of some of the peculiarities of information as a resource and a sense of what resource management is all about, we can consider some of the definitions for information resources management. The Associated Information Managers define information managers as "members of the management team responsible for acquiring and developing the information content and technology resources suited to the needs of their organization" (AIM, 1980). They further suggest that information managers "fill the gap between the process-oriented information function, such as data processing, library science, information and communication technology, and records management, and the management functions of the executives with information-intensive responsibilities, such as planning, marketing, legal, financial, research and development" (AIM, 1980).

Horton (1980) takes a more functional approach. He divides the organization's information resources into sources, services, products, and individual information systems. Sources and systems are instrumental and ongoing; information products and services are more finite and consumption oriented. He includes under his definition of information resources all personnel information systems, payroll information systems, inventory information systems, program management information systems, marketing information systems, manufacturing information systems, and so on. He suggests that information managers are concerned with both the substance and the context of each of these functionally oriented information systems, and with knowledge of their identity, location, purpose, and use. Information managers do not have to understand the internal functioning of the systems, but they must see and understand where they fit in the overall scheme of the organization. Horton concludes that information resources management has two separate and distinct dimensions: the management of the information process, and the management of the information resources used in that process.

In an elaborate and elaborated definition, Schneyman sees information resources management as:

> The management (planning, organization, operations and control) of the resources (human and physical) concerned with integrated systems support (systems design, development, enhancement and maintenance) and the servicing (processing, transforming, distributing, storing and retrieving) of information (data, text, voice, image) for an enterprise. (Schneyman, 1982)

Schneyman distinguishes between information resource management, which he sees as the activities relevant to managing particular kinds of data, and information resources management, which he sees as a larger term encompassing the organizational disposition of the various information processing, transforming, communicating, and storing units. He advocates an integrated information resources organization which would be organized functionally into three components. All planning and technology decisions for data processing, telecommunications, office management, records management, libraries, and technical information centers and reproduction units should be centralized in his view, as well as system support and all operations and services for these elements. His proposal is directed

to the Mobil Corporation of which he is the Director of Systems and Computer Services, but clearly has application in other large corporations.

Still another definition comes from Robert S. Taylor and his colleagues in the School of Information Studies at Syracuse University. Information resources management is defined here as, "The design, management and evaluation of cost-effective systems (i.e., appropriate combinations of people, information and technologies) to fulfill the objectives of the particular corporate body (or group of clients) by providing an efficient flow of information to those who need it when they need it" (Syracuse University, 1980). The emphasis of the Syracuse program is on the intellectual and professional breadth of education required in order to produce people who can perform effectively in a variety of contexts with a range of systems and information and with diverse clients and needs. Its perspective is one of process. What information resources managers do defines what information resources management is. There are many other definitions (see for example, Brinberg, 1982; Barnett, 1981; Department of the Army, 1980; Shirley J. Smith, 1980; Jane H. Yurow, et al., 1982), but they differ only in emphasis from the ones already cited.

It is clear from the foregoing that information resources management is a relatively new field and that there is not a commonly agreed upon set of terms or a scope definition for it. For the purposes of this paper, we will draw from the above and focus on the function of information resources management in an organization rather than the people who perform the function. This function will include (1) management of data resources collected in the expectation that these data stores will yield important information in the future; (2) the transmission of information internally from one part of the organization to another, thus linking the parts of the organization into one cohesive whole; and (3) the monitoring of the external environment to acquire information useful in long-range planning and policy making. Good information management is seen as crucial to the survival of all organizations in the future.

What Are the Roots of Information Resources Management?

There are three major "information worlds" which have traditionally been divided and separate. The first is the literature world of libraries and archives, where information has been received in recorded form and meaningfully organized. Significant amounts of human judgment are required for the selection, organization, and retrieval from this information store. The second, the document world of information centers, clearinghouses, documentation centers, and record centers, differs in that although recorded information is selected and organized, it is not evaluated in the same sense as in the literature world. The third information world is the data world of computers, telecommunications, and automated information systems, where the information is often numerical and where little evaluation takes place. Two key variables distinguish the three groups--the time-frame and the storage medium. The library focuses on the historical; its storage medium is predominantly books or other recorded format. Information centers are more current and concerned chiefly with storage in document form. Finally, there is the rapidly changing, machine-readable world of the computer.

There are clearly different ways of thinking about and dealing with these three types of information. Database management experts deal mostly with unanalyzed, concrete raw data. Management information systems experts are concerned with current information and the context in which it occurs. Information storage and retrieval experts are those who deal with collections of books and other artifacts that contain recorded knowledge. Yet all three are concerned with the most effective, beneficial ways of collecting, storing, retrieving, analyzing, synthesizing and evaluating their particular set of information responsibilities. All three also have a concern with computer hardware, telecommunications, and media and display technologies.

It is proposed that in the future these three kinds of information resources, and perhaps others associated with particular functions (reproduction, telecommunications, etc.) should be integrated into a single coordinated organizational framework. These information resources, or data, can then be drawn upon in the world of human communication where information is exchanged in social and interpersonal context. Humans summarize and interpret the information resources they receive. Humans are also heavily

influenced by their individual perceptions and past experiences in their interpretation and use of information. They are further affected by the organizational structure and the channels through which information flows. Human uses of information will be considered in the next section.

## Information Use and Decision Making

> The capacity of the human mind for formulating and solving complex problems is very small, compared with the size of the problem where solution is required for objectively rational behavior in the real world--or even for a reasonable approximation to such objective rationality. -- Simon, 1957.

In studying the process of decision making there seems to be a clear correlation between the kinds of decisions being made (i.e., the stage in the decision making process) and the nature of information needed and its appropriate form. Models of the decision making process often are divided into a series of stages. Simon, in perhaps the most frequently cited description, sees decision making as occurring in three phases with different information processing activities connected with each phase. He calls these phases intelligence, design, and choice (Simon, 1977).

The first phase of decision-making--intelligence--involves the perception and formulation of the problem. During this phase the environment inside and outside the organization is searched for conditions required during a decision and information is gathered with respect to these conditions. Better problem definition takes place in rich information environments where many divergent pieces of information are available. In the design phase, possible courses of action are determined and analyzed for their relative values as solutions to the decision problems that have been detected. Here more specific information relating to each alternative and the probabilities associated with various outcomes is required. In the final phase, choice, an available course of action is selected to convert the present, less desirable situation into a future situation judged to be more desirable. This stage requires more corroborative and convergent information. For information use to follow an optimum pattern for decision making, we may need to place less emphasis on the technical structure of information (i.e., data) systems and more on the behavioral attributes of information users.

The early success of management information systems promised a more rational approach to decision making than they have been able to deliver thus far. MIS seems to work well on the operational level of the organization where data has been categorized into predefined meaningful bits of information. However, higher level managers deal

with less structured information, and information use and decision making is much less easy to categorize and capture ahead of time. Decision support systems are designed to support the manager through analytical aids, computational speed, and the ability to respond with new combinations of data in response to "what if?" questions. (For more complete descriptions of decision support systems, see, for example, Keen and Morton, 1978; and Radford, 1978.)

Research by McKenney and Keen has shown that managers use different cognitive styles in solving problems and making decisions (McKenney and Keen, 1974). Some managers consume information holistically and voraciously; others are focused and prefer one thing at a time. One manager may prefer details, another summaries. Some people think numbers contain more information than text; others prefer word of mouth. It is clear that those that prefer a factual and holistic approach are more hospitable to the use of information than are those with different characteristics. People do, however, fall into patterns in their use of information and these patterns are predictable. Good information resources managers consider the ways in which individuals use information as well as the stages in the decision process and their relationship to the use of information.

McKenney and Keen categorize tasks in terms of the ability to recognize and act on relevant information. They identify four classes of problems, classified according to whether data are available to solve the problem and whether the problem solver has the cognitive/manipulative power to deal with the data in a meaningful way. Planning problems are those where data are known and the effort involved in arranging the data in a useful form is also known. Intelligence/search problems are those where the data are unknown but the necessary operations and methods to deal with the data once they are found are known. Invention problems involve known data but unknown methods, and research problems are those where both data and methods for manipulating them are unknown. This suggests that information systems, both formal and informal, should take into account the cognitive style preferences of managers, as well as the type of problem and the stage in the decision making process. Those who deal with the use and integration of information resources must understand these concepts in order to provide information in the right format at the right time and place.

Still another factor affects information use in organizations. This is the organizational structure in which information processing takes place. Individual styles of information consumption and types of problems, although predictable and useful in matching information flow to the prescribed needs, are not aspects that can be easily changed. However, it may be possible to restructure the organization to control the flow of information for more efficient and effective results. The next section deals with this issue.

An Information Processing View of Organizations and Its Relationship to Information Resources Management

Recently a number of people who have studied the design of organizations and the impact of the structure of the organization on the behavior of people within it have begun to take an information processing view. For example, Galbraith postulates that the basic problem confronting any organization is how to deal with uncertainty. He defines uncertainty as, "The difference between the amount of information required to perform the task and the amount of information already processed by the organization" (Galbraith, 1977). If the task is well understood before its performance, then much of the activity can be preplanned. If not, then information must be acquired during the task execution which can lead to changes in the allocation of resources, changes in schedules, and changes in the level of performance. When the organization does not have the necessary information, it must acquire it and make and remake decisions during the actual task performance. The greater the uncertainty, the greater the amount of decision making and information processing. As organizations have limited capacities to process information, they adopt different organizing modes to deal with task uncertainty.

The technique that most organizations use to process information more efficiently is the hierarchy. If coordinating information is passed directly, then the number of communication channels grows as the square of the number of units, reaching very large numbers very quickly. A hierarchy reduces the number of channels that each unit must maintain and yet ties together all the independent units. Hierarchy, then, economizes on information processing capacity. School systems, virtually without exception, rely on a hierarchical structure. Each level within the hierarchy deals with a different type of information. This type of organizational structure works fairly well in times of high stability, but less well when the environment is changing.

Even in times of stability, there are some difficulties with the pure hierarchical model. It assumes that subunits do not need to communicate with each other and, indeed, they are often constrained from doing so. For example, think of the traditional, isolated classrooms still common today, where each teacher has little opportunity to share information with other teachers. Task uncertainties are to be resolved by applying to the next level of the hierarchy (i.e.,

the principal). Depending on the ratio of number of teachers to principal, large increases in task uncertainty may overload the hierarchical channels and introduce delays and distortions.

Organizations use other mechanisms to counteract the problem of too much information clogging the upward and downward channels of communication within the hierarchy. One mechanism is the employment of rules or procedures, that is, decisions made in advance of their execution which eliminate the need for communication between interdependent units and between superiors and subordinates. Rules serve the same function for an organization as habits for the individual: they preserve the scarce information processing decision making capacity for novel and important events.

Thus, school systems frequently generate multiple rules and compile them into manuals for principals, teachers, aids, support staff, and students. The individual, confronted with the need for information, can then have recourse first to the set of rules before resorting to the superior, hierarchical level for needed information. Uncertainties not covered by the rules are appropriately referred up the hierarchy. However, as the subtasks increase in uncertainty, fewer situations can be programmed in advance and more exceptions arise which must be referred upward in the hierarchy.

Another technique is to increase the amount of discretion at lower levels by employing professionals or by engaging in planning processes to set goals or targets to cover primary interdependencies. The school system, by employing certified teachers and school librarians, has expectations that their previous professional training will have prepared them through socialization and the internalization of an organized and systematic information store about various predictable contingencies relating to their positions. However, the professional training of one group of workers may be quite different from what co-workers might assume it would be, based on their past experience. The role of the school librarian, for example, as learned in modern library science educational programs, may be greatly at variance with the expectations and assumptions that teachers have for those practicing this role. For various professional groups to work together smoothly, sharing information implicitly through assumptions about the way others will perform their roles, may require an additional coordinating mechanism. Frequently this is the

formal planning process. Thus, periodically, various groups may be required to meet and develop plans with particular specified goals and objectives. These planning documents serve to reduce the amount of information processing required for each participant as uncertainties are reduced through the planning process.

As the size of the organization increases, greater decentralization of decision making to professionals is required to deal with the flow of information. This differentiation then, in turn, requires more integrating, planning, and programing activities. The greater the number of sources of information and exceptions that flow up the hierarchy, the smaller the span of control the manager can cope with. If we assume that uncertainty increases as we move up the hierarchy, the greater the uncertainty, the smaller the span of control. At the middle-management level of principal, there is much less uncertainty than there is at the superintendent's level of top management. It would follow from this that the principal would have a larger span of control, that is, more individuals who report directly to that position. The superintendent, on the other hand, often has only two assistant superintendents reporting directly to him or her.

The net effect of decreasing span with increasing uncertainty is to make the hierarchy taller and to increase the proportion of manager's salaries relative to operational salaries. In our example, the superintendent and his/her assistants who must process greater amounts of information have salaries that reflect this responsibility. The more programmed the department, the less information to be processed because of fewer uncertainties, and the lower the salary. Teachers are paid less than principals, who are paid less than assistant superintendents, and so on. If another layer of administration seems necessary to coordinate and process the flow of information (for example, a school may have a set of directors of secondary education, elementary education, an audiovisual curriculum, etc., who report to one or another assistant superintendent), the need for additional layers increases as the complexity of the operation increases, and the proportion of salary for administration then increases in relation to the proportion of salaries for instructional support. Organizations try to match the amount of information to be processed by either reducing the need for information to coordinate activities or by increasing the organizations' capacity to process more information.

The foregoing discussion deals with ways in which organizations try to increase their capacity to process information. Three methods used to limit the amount of necessary information to be processed are described below.

One method is through attempting to modify the environment, that is, trying to reduce uncertainty about critical events. Through vertical integration, the organization can incorporate other stages as part of itself. In the school system, for example, providing breakfast for students reduces the uncertainty about whether they have come with the energy and readiness to approach their learning tasks with alacrity. In another example, the business office may seek to purchase its own computer and hire its own programmer and systems analyst to reduce the uncertainties and the amount of information that would have to be transmitted to an independent, external unit. The organization can also use public relations techniques to influence the environment, engage in cooperative schemes with other organizations, or search for new markets where uncertainty is less. To an extent, school systems attempt to "sell" their communities on particular approaches to educational issues to preclude great demands for information about reasons for doing or not doing some action. School systems might enter into cooperative agreements with regional educational agencies for maintenance contracts for audio-visual equipment or for a centralized accounting service. The search for new markets is taking place in community college systems where the adult continuing education market is seen as less uncertain than the typical college age freshman and sophmore group.

Another approach to reducing the amount of information to be processed is to reduce the difficulty of performance required. Usually this means consuming more resources, particularly time or man hours. An example occurs in the provision of food service, where accuracy of prediction about quantities of each type of food to be consumed requires such a high degree of information processing that the alternative of buying a greater amount than needed is preferred. Even though it wastes a certain amount of food, it guarantees good customer service and easier interaction with food suppliers. The creation of slack resources in this way can be an additional cost to the organization, or it may be passed on to the client. In the example given, the food service department might overestimate their budget to allow for excess supplies, or the cost of unused food may be added to the cost of the lunch, and so passed on to the student.

Still a third method that reduces the amount of information to be processed is the creation of self-contained tasks. Instead of subdividing the tasks functionally, self-contained units can be created by geographical areas, client groups, projects, or product/service specialties. This strategy of self-containment shifts the authority structure downward and reduces the amount of output diversity for each collection of resources. Choices for determining priorities for different client groups disappear. There is also less division of labor so there are fewer occasions to coordinate efforts. For example, an organizational arrangment whereby each school in a system operates as a semi-autonomous unit for one or more special functions (such as purchasing supplies and equipment, contracting for janitorial service, or hiring teachers, aides, and clerical support) means that there are fewer exchanges of information with the central office and fewer specialized groups to coordinate.

Thus, organizations have three choices when desiring to reduce the load on the hierarchy of dealing with too many exceptions. Each method described above reduces the flow of information into and within the organization through (1) reducing the level of performance, (2) decreasing the extent of division of labor, or (3) reducing the diversity of the output. In a classic article, Meier (1963) analyzes how growing communications-oriented organizations cope with information overload. He suggests that a sequence of events can be predicted beginning with queuing, then setting priorities in the queues and dropping out the lowest priorities, moving to file redundancy and duplicate branch facilities, to the addition of middle men or liaison positions, and the creation of a mobile reserve. Explicit performance standards may be specified and then the standards reduced. Customers may be asked to serve themselves in some ways. If information overload continues to persist, people drop out, either by resignation or by remaining in the firm and working to rule somewhat rigidly and ritualistically. His analysis demonstrates in specific ways how a service organization resorts to a variety of methods, each of which reduces the amount of information to be processed.

As an alternative to becoming information poorer, the organization may choose instead to maintain the level of information to be processed and create ways to increase its information processing capacity. One way is to invest in vertical information systems which increase the capacity of existing channels, create new channels, and introduce new decision techniques. These methods usually involve

computers and the new information technology. More information processing will be invested in planning and in changing plans as close monitoring shows exceptions occurring. These formal information systems increase the capacity of the decision maker, but also mean that fewer exceptions are referred upward in the hierarchy. Thus, a computerized system for monitoring expenditures against budget and comparing proportions of budget expended at a particular time period against that same category in previous years provides a much greater amount of information, but in a form that requires little effort on the part of the decision maker to monitor the process.

The use of lateral decision processes, which move the level of decision making down to where the information exists instead of bringing the information up to the point of decision, also increases the organization's capacity for information processing. This decentralization of decision can be as simple as two people from different departments meeting to solve a problem directly without referring it up to another manager. In more complex situations where high uncertainty exists, a task force or team can meet to resolve the problem. As more important decisions are made at lower levels, the need arises for the creation of a new integrating role whose function is to represent the professional in the interdepartmental decisions that are being made. The faculty representative to a curriculum development committee is one such example. As Lawrence and Lorsch (1967) point out in their landmark study, the more differentiation that takes place within an organization, the more coordination becomes necessary. Here, differentiation through decentralized decision making allows greater amounts of information to be processed, but at the cost of greater amounts of managerial time being spent on group processes plus the overhead expense of creating liaison and integrating roles.

An information processing view of the organization, then, suggests that hierarchical organizations seek to respond to their ongoing information processing needs either through reducing the causes of information expansion by reduction of performance levels, reduction of the variety of output, or reduction of the amount of specialization, or they can respond through increasing the capacity of the organization to deal with greater amounts of information through investing in formal information systems, or by introducing participative decision processes with liaison roles.

Information resources management is concerned with solutions that increase the capacity of the organization to process information. It is important, however, to realize the tradeoffs involved.

## Challenge to Educators in the Future

Public education is in trouble in this country. There is discontentment with the quality of the student product. There is criticism of the internal management of the school. Education is a highly labor-intensive activity, and because of this and inflation-linked salary increases, costs continue to climb. Technology, with the exception of the few Sesame Street entertainment/education programs and their spinoffs on television and some isolated attempts to use computers for record keeping in scattered and unrelated ways, has made remarkably few inroads in the way education is delivered.

In large universities, a more dedicated effort has been made to make use of information processing technology to centralize and rationalize certain information flows. It has not been an entirely successful effort, as it has taken place largely outside the central area where the process of education goes on. There are a variety of automated information systems--accounting, admissions, student records, alumni information, and the like--that act to collect, organize, and summarize administrative data, theoretically for various points in the organization, but primarily for central administration. Each of these information systems exists autonomously, is administered by a person who is not an academic, and carries on a curiously independent life at the margins of the university. However, the demands of data gathering must be fed primarily by the academic unit, which itself requires data resources to operate. The result is often two parallel systems.

As an example of this curiously maladapted system, in one university there is a centralized automated accounting system. All invoices for each academic unit must be sent to the central unit by paper copy. The academic unit must duplicate the copy in order to have its own record. The central unit enters the data into the administrative computer system and issues batch reports to the academic unit at intervals showing the distribution of costs and the status of the account. This, however, takes time and the reports typically arrive six weeks after the expenses are incurred. The academic unit, in order to understand its financial situation, has undertaken to automate its own operation so that before the paper invoice is sent to central accounting, it is keyed into another system which does the same thing as is done by the central system, but it is immediate and under the control of the academic unit. When the

central report arrives, it is compared to the paper copy and also against the other automated system in order to reconcile the account. The paper invoice is filed at both ends.

This is only one example of what frequently happens when single functions are automated and centralized. There arises the question of ownership of data. Any time the ownership of the data seemingly lies outside the unit where the data resources are to be used or are generated, one can see the development of a second information system, whether it be paper records or another automated system. With the technology available to us, such duplication of records is wasteful and nonrational. No data should ever be converted to machine-readable form more than once. The advent of photoduplication technology has made us all reluctant, and rightly so, to rewrite or retype anything in written form. The parallel is clear. The technology is now readily available to move machine-readable data from one system to another with a minimum of difficulty.

To return to the examples cited above, the invoice data could be entered at the point of receipt into a work space within the computer that would allow the academic unit to see immediately its current balances in a variety of combinations. The central account unit could then look in the work space and examine and verify the accuracy of the entry before adding it to the official balances and combining it with the entries of all other academic units. There would be a minimum of paper movement and only one data entry. Ownership of the information resource would be shared and sufficient protection could be assured. This is only one example of more efficient and effective information resources management.

Price (1981) asserts that "information is gradually being recognized as a valuable asset alongside capital and labor. It is also being recognized as one of the major factors of productivity." However, he points out that there are several reasons why he believes that information processing and management of information will continue to play a secondary role in relation to mission-oriented programs. Among these reasons are that information is considered as process and procedural (non-substantive), that there is a natural arrogance toward information (if we are experts, why do we need more information?), that there are conflicts in considering information costs and meeting program mandates, and that the value of

information is intangible, but the cost of collecting and processing data is well defined and concrete.

There has to be a bonding agent to bring together the user, the information needed, and the appropriate information processing technology to make the unit efficient. Many resources--human, technological, supply, and financial--are consumed in creating the asset of information. The life cycle of information must be considered. On the resource side, the life cycle of information includes: (1) creation of information resources through drafting, revising, and keyboard entry; (2) organization, storage and maintenance; (3) transmission and communication; (4) delivery and receipt; and (5) compilation and repackaging into other information products. On the user side the life cycle of information follows the decision making/problem solving cycle--(1) problem identification and definition, (2) the design of alternatives, (3) choice of action and implementation, and (4) monitoring and evaluation. It is the function of information resources management to manage both sides of the life cycle--the resource side and the user side. Combined support for computer and communications technology, word processing and office automation, information services, records, and information management are necessary to maximize the value of information and reduce the cost of delivering and maintaining information resources. Information solutions must focus on freeing human resources from routine tasks to increase the productivity of managers and decision makers.

Some of the basic characteristics of information systems in the future, according to Yurow, Wildavsky and Pogrow (1982) will be:

> More cost-efficient powerful computers which will promote the development of decentralized, interactive information systems;
>
> integration of communication, word processing, and data processing--a total electronic environment;
>
> more automated modes of data input;
>
> direct interaction by non-technicians with data which will enable them to make their own modifications and use their own cognitive processes on the system to convert data into information;
>
> and, integrated data bases which permit the sharing of data between applications. (p. 43)

To move from the condition of data surplus and information scarcity, where we are now, to a more rationalized and managed future where information flows to the needed points naturally and easily will require careful planning. A useful first step is to undertake an information audit of the organization, determining where information resources (i.e., records) presently exist, how they are organized, maintained, and accessed, whether or not there are duplicate records, and whether all those who might profitably make use of these resources are informed and aware, and in fact do use them. This kind of audit must be in two parts--one part that examines the records and the other that considers human use of information in the organization. The audit will provide the dimensions of the problem. Involvement of an information specialist who understands the cost benefit tradeoffs of various available technological solutions and the techniques of gathering, organizing, and storing information resources, and who also understands human information flows in organizations in combination with the end users of information, will create a more effective integrated information resources management system for the organization.

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Appendix: ERIC BIBLIOGRAPHY

## Historical Antecedents

EJ234683

**Information Resources Management (IRM): A Revolution in Progress.**

Becker, Louise Giovane

Bulletin of the American Society for Information Science, v6 n6 p26-27 Aug 1980 (Reprint: UMI)

Discusses the emergence of information resources management (IRM) as a focus for managing information activities, particularly those related to federal administration. The IRM office and its manager are described within the context of an organization. Impact of the Paperwork Reduction Act of 1980 on IRM is discussed.

ED149426

**A Report of the Commission on Federal Paperwork. Final Summary Report.**

Commission on Federal Paperwork, Washington, D.C.

3 Oct 1977 85p.; For a related document, see ED 144 203

EDRS Price - MF01/PC04 Plus Postage.

The Commission on Federal Paperwork was charged by Congress and the President with the task of making recommendations to eliminate needless paperwork while assuring that the federal government has the information necessary to meet the mandate of law and operate effectively. The 36 reports of the commission (summarized in the appendixes) examined 18 major program areas such as tax, occupational safety and health, education, health, and housing; 13 government processes, including rulemaking, information resources management, forms clearance, and the role of Congress; and the cost and other burdens of paperwork for five segments of the economy. Almost 50 percent of the 770 recommendations that were made are now being implemented by Congress and government agencies. The findings and recommendations of the committee are summarized in the report.

EJ235709

**Paperwork: The Educator's Nightmare.**

Robison, Wendell A.

Clearing House, v54 n3 p125-26 Nov 1980 (Reprint: UMI)

The author traces some of the causes of the paperwork explosion in public schools over the last 20 years and concludes that, unfortunately, there is little relief in sight.

## Impact on Education

EJ173487

**Crises Administration: Is There a Solution?**

Dallas, Joe D.

NASSP Bulletin, 62, 415, 13-7 Feb 1978 (Reprint: UMI)

Crises administration makes planned, coherent administrative action difficult. To assist school administrators in solving a multitude of problems, the author advises that administrators adopt a systems approach that starts with needs assessment.

EJ197837

**An Educational Computing Consortium: A Sociological Perspective.**

Foecke, Jerome F.

AEDS Journal, v12 n2 p84-94 Win 1979 (Reprint: UMI)

Examines the external change forces in the environment and their resultant impact on the internal structure and activities of an organization designed to jointly develop uses of computers and data processing techniques to facilitate the administrative, instruction, and research activities of member school districts.

EJ193971

**The Impact of Computer-Based Information Systems Upon School and School District Administration.**

Hansen, Thomas; And Others

AEDS Journal, v12 n1 p1-10 Fall 1978 (Reprint: UMI)

This study investigates the ways in which computer-based

information systems interact with the strategic planning, management control, and operational control in 11 Minnesota school districts.

EJ234604

**Information Resource Management: Meeting the Challenge.** West, Thomas W.

CAUSE/EFFECT, v3 n5 p12-17,20-21 Sep 1980

The experience of Indiana University in managing information resources--computing, word processing, telephone services, mail services, microfilming, and duplicating services--in a more integrated fashion is described and strategies to overcome tradition, the fiefdom syndrome, and institutional inertia are detailed.

ED192745

**LEA Basic Data Systems. A Manual of Developmental Activities.**

Powers, Roderick W.

Alabama State Dept. of Education, Montgomery. Div. of Research and Information Services.

Jul 1977 127p.; For related document, see ED 192 740.

Sponsoring Agency: Office of Education (DHEW), Washington, D.C.

Available from: Planning and Evaluation Section, Room 558, State Office Building, Montgomery, AL 36130

EDRS Price - MF01/PC06 Plus Postage.

Intended to assist school administrators in developing both student information systems and total information systems, this guide contains suggestions which, when considered in terms of local characteristics and concerns, can be used to create such systems to support administrative decision making, state and federal reporting, guidance, research, and strategic planning. Fifteen activities in the development of basic information systems are detailed: (1) obtaining the necessary local education agency (LEA) commitment, (2) establishing a relationship with the LEA, (3) appointing the LEA coordinator, (4) advisory committee selection, (5) forms needs assessment, (6) identification of data needs, (7) refinement of data needs, (8) input-output forms preparation, (9) input-output dictionary preparation, (10) developing procedural materials for data collection, (11) field testing, (12) materials revision, (13) creating file systems, (14) writing operating procedures for data retrieval, and (15) formatting final orientation sessions. Appendices contain worksheets for each activity.

ED188668

**Taking Charge of the Eighties: Planning and Management in Higher Education.**

Rossmeier, Joseph G.

18 Feb 1980 16p.; Paper presented at the Annual Meeting of the Southern Association of College and University Business Officers (52nd, Williamsburg, VA, February 18, 1980)

EDRS Price - MF01/PC01 Plus Postage.

The effects of declining enrollments, rising costs, increasing public scrutiny, diminishing financial and energy resources, and emerging environmental impact considerations will be felt by all institutions of higher education, regardless of institutional type. To cope with these threatening issues, a strategic planning process must be developed which places significant emphasis on the resources to be integrated and coordinated. Such a process must include a pre-planning phase, a needs assessment mechanism, a mission statement, achievable institutional goals, comprehensiveness in scope, a key planning officer, executive management commitment, involvement of staff on all levels, short- and long-range goals, a cyclical structure, use of information as the basis for planning, data collection and coordination of information linkages, flexibility, a priority-setting mechanism, a tie between planning and budgeting, institutional research, synchronization with state planning processes, and a routinely updated master plan. A second major management component over which institutions must gain better control in the future, is information resource management. Extending beyond the traditional scope of computing services, information processing in the future should also include text management and computer/communications networks, in order to bridge the information gap between data processing and the management decision-making process.

## Needs Assessment

ED159143

**A Decision-Support System for Designing Inservice Programs for Educators: Survey Instruments and Guidelines for Their Use.**

Davis, William J.

1978 49p.

Sponsoring Agency: University Council for Educational Administration, Columbus, Ohio.

EDRS Price - MF01/PC02 Plus Postage.

The purpose of this document is to report a needs assessment questionnaire package based on the position that needs assessment surveys should gather the preferences of prospective participants regarding all modifiable aspects of an inservice program. The package consists of two instruments that may be administered either separately or in combination. The first instrument, the Experience-Interest Inventory, illustrates a form for assessing prospective participants' relative interests and levels of experience regarding a number of program topics. The second instrument, the Design for Staff Development Preference Inventory, asks respondents about areas relevant to the motivational and structural design of the intended inservice program. Each instrument was administered to over five hundred principals of urban and Title I schools across the nation. A preliminary analysis of results suggests that administrative inservice programs fashioned after the preferences of this national sample of principals tend to exhibit higher levels of participant satisfaction with the program than do programs not so designed. The rationale upon which the instruments are posited is discussed. Subsequent sections of the report present the instruments themselves and list computer programs that can be used to score the instruments. The report concludes with a brief description of a "model" inservice program drawn solely from data obtained through application of the questionnaires.

EJ238590

**Information Systems for Vocational Education Programs: Needs of the Local Education Agency.**

Skinkle, John D.; Foecke, Jerome F.

AEDS Journal, v14 n1 p1-15 Fall 1980 (Reprint: UMI)

To realize the ultimate potential of a management information system in a local school district it will be necessary to address problems related to the system's data elements, the compliance mentality of vocational educators, and the lack of local expertise specific to the operation and utilization of these systems.

ED168118

**Information Systems Plan.**

Tulsa Public Schools, Okla.

Oct 1978 58p.; Prepared by the Information Systems Task Force

EDRS Price - MF01/PC03 Plus Postage.

A task force sought to determine the information needs of the Tulsa Public Schools (Oklahoma) by studying goals of the school district, identifying all processes necessary for operation of the school system, and conducting interviews with 48 key members. A detailed information systems matrix was constructed to show the interrelationships between departments within the organization, the process essential to the operation of the schools, classes of data required, and necessary information systems. Among nine conclusions reached by the task force was that a district crisis in data processing appears imminent. The "application approach" being followed seriously restricts access to data, and there is excessive manual processing of data. Also, present data processing equipment, systems, and staff are inadequate. The task force made 12 recommendations, including that data processing capabilities should be upgraded immediately and an integrated data base developed; a long-term commitment must be made to the project; priority should be given to data bases in student, financial, and personnel records; and early emphasis should be given programs that directly serve students. A lengthy appendix discusses methodology, process definitions, current systems review, interviews, analysis of information systems needs, the information systems network, and risk assessment and prioritization.

ED147957

**A Management System for Developing a Comprehensive Education Plan for Lanier County, Georgia.**

Nallia, William T.

Lanier County Board of Education, Lakeland, Ga.

1974 32p.; For related documents, see ED 197 958-959

EDRS Price - MF01 Plus Postage. PC Not Available from EDRS.

This publication describes a management system developed by the Lanier County (Georgia) Public Schools for use in developing and managing a comprehensive education plan for the county's schools. The management system is intended to provide a structure for moving from what Lanier County citizens believe about public education to the identification of specific activities involving students and teachers. It is organized in a logical sequence of ten steps that correspond to the components of the overall education plan. These steps include (1) establishing an educational philosophy reflective of the county's citizens, (2) defining students' needs and interests, (3) establishing broad program goals, (4) determining the current status and needs of the educational program, (5) formulating objectives, (6) defining broad program concepts, (7)

identifying activities to achieve the objectives, (8) identifying specific program and management needs for implementing the activities, (9) evaluating results of the activities, and (10) disseminating information to the school community. Each step of the management system is described in a brief separate section, and a detailed timeline for developing the comprehensive education plan is also included.

ED188326#

**Responsive, Evaluative, Accountability System Operating Newark Schools.**

Newark City School District, Ohio.

1980 64p.

Available from: Newark City School District, East Main at First St., Newark, OH 43055 ($9.00)

Document Not Available from EDRS.

This report describes an accountability program--the Responsive, Evaluative, Accountability System Operating Newark Schools (REASONS)--used in an Ohio school district. First, the planning model is discussed, including a rationale for a management system that will assess and improve education in the district. Next, developmental objectives and management of those objectives are reviewed. Finally, the report discusses how to evaluate and reward performance of members of the administrative team. A copy of the school survey used to solicit suggestions from the community for improvement is included.

## Educational Applications

EJ238646

**Automating Your Property Records System.**

Nickens, John

Journal of Education Finance, v6 n2 p258-63 Fall 1980

Discusses such topics as selection of data elements, the entering and updating of data, and the computer software for an automated property accounting system.

ED187855

**CIS Implementation Handbook.**

Steward, Naomi; Wiles, Jeff

Oregon Univ., Eugene. Career Information System.

Sep 1978 295p.; For related documents see ED 151 514 and ED 187 853-854.

Available from: Oregon Career Information System, 247 Hendricks Hall, University of Oregon, Eugene, OR 97403 ($11.00)

EDRS Price - MF01/PC12 Plus Postage.

This handbook for school and agency staff presents information on implementing a Career Information System (CIS). Section 1 describes the content, format, and use of CIS information files. Each type of file is discussed individually and sample printouts are included. Section 2 provides materials on QUEST, the twenty-one question process by which the user constructs an individual profile by expressing work/job preferences that are matched to an individualized list of occupations. Section 3 concerns these topics regarding site coordination: standards for CIS use, publicizing CIS, involving faculty, CIS and the guidance process, utilizing paraprofessionals and student aides, career resource centers, CIS statistical package, and troubleshooting. Additional resources provided in section 4 include a glossary and resource lists compiled by Seattle Public Schools, including student reference materials, reference books for students, professional reference, and kits and sets. The final section, amounting to over one-half of the manual, consists of learning activities developed by users or site coordinators for implementing CIS in counseling centers and classrooms. Activities are grouped into career guidance and the subject matter areas of language arts, social studies, science, mathematics, physical education, art, personal finance, business, industrial arts, health, and food services.

ED160059

**Computer Simulation of the Supply and Demand for Teachers in Michigan Public Schools.**

Smith, Gary R.; Shallwani, Inayat

Jan 1978 46p.; Paper presented to the American Educational Research Association (Toronto, Canada, April, 1978)

EDRS Price - MF01/PC02 Plus Postage.

The application of a computer simulation of various aspects of the supply and demand for teaching personnel is illustrated with data in the public domain. In addition to several of the variables used

in previous simulations of teacher supply and demand, two new features are introduced in this simulation model: a new mechanism for simulating the preservice teacher training component as it supplies new teaching personnel, and new alternatives for considering various categories of certified teachers who may remain in the pool of available teaching personnel for varying lengths of time. A sample computer program and histograms of simulation variable frequency distributions are included.

ED199804#

**Control Points in School Business Management, Presenting General Observations, Specific Control Points, and a Series of Checkpoints for the Practicing School Business Administrator.**

Association of School Business Officials, Chicago, Ill.

1979 20p.; Revised outline of an address at the Annual Meeting of the Association of School Business Officials (48th, Dallas, TX, October 15-19, 1962) by Dr. Schyler C. Joyner.

Available from: Publications Dept., Research Corp. of the Association of School Business Officials of the United States and Canada, 720 Garden St., Park Ridge, IL 60068 ($3.00).

Document Not Available from EDRS.

This revised outline of a 1962 address contains general guidelines considered still useful for practicing school business administrators. Introductory "general observations" and a preamble give advice about good personal qualities, policy and planning practices, and relations with school boards, community, staff, and fellow professional administrators. After defining the function of school business officials--to provide necessary resoures, personnel, and planning for meeting school goals--the outline touches on 11 major areas of school business administration. In each area it lists critical components and suggests proper actions. The areas covered are (1) business division organization, including relationship to the school district, lines of authority, and people and paper management; (2) business personnel recruitment, salaries, dismissal, and communications; (3) accounting functions, such as budgeting, money handling, and auditing; (4) facilities management and administrative, construction, custodial, and maintenance services; (5) pupil transportation, especially buses and bus drivers; (6) purchasing procedures, buying policies, and costs; (7) warehousing, to save space and money and control inventory; (8) food services, and the problems of productivity, costs, and contracting; (9) insurance requirements, distribution, and

selection; (10) data processing, including selection of services and delivery systems; and (11) educational resources management systems (ERMS), for organizing necessary information.

ED194093

**Decision Support Systems in Libraries.**

Heindel, Allan; Napier, H. Albert

1979 29p.

EDRS Price - MF01/PC02 Plus Postage.

Following a review of the contributions of computers and managerial science/operations research to the management of libraries, this paper introduces the concept of decision support systems. DSS, a blending of these techniques, can lead to more effective decisions by library managers. A case study of the utilization of a DSS in the budgeting process of a medium sized library illustrates the process. Footnotes provide 23 references.

ED142866

**Description of the New York Educational Information System: Pupil Personnel Information Subsystem. Internal Note No. 3 (Revised).**

New York City Board of Education, Brooklyn, N.Y. Office of the Deputy Chancellor.

8 Nov 1974 104p.; Exhibits may be marginally legible ; Prepared by Information Systems Development Unit

EDRS Price - MF01/PC05 Plus Postage.

This report describes some of the characteristics and benefits of the New York Educational Information System, a computerized pupil personnel system which is being developed to furnish schools with a comprehensive means of processing and storing pupil data for use by teachers, counselors, administrators, and educators at all levels, through the utilization of modern electronic computers. The system is described, and ways in which it can be used to improve decision making are delineated. Samples of forms are included.

ED182521

**The Development and Testing of a Statewide Multilevel Curriculum Management System for Georgia Vocational Education Programs. Final Report.**

Scott, Paul; Butler, Ray

Georgia Univ., Athens. Div. of Vocational Education.

2 Oct 1979 155p.; Not available in paper copy due to light type; For related documents see ED 182 485-486

Sponsoring Agency: Bureau of Occupational and Adult Education (DHEW/OE), Washington, D.C.

EDRS Price - MF01 Plus Postage. PC Not Available from EDRS.

Focusing on the management of vocational curricula with a special emphasis on individualized instruction, a research and development project had a fourfold purpose: (1) design and development of a statewide curriculum management system (CMS), (2) testing of that system by developing additional individualized student materials and adapting existing materials, (3) preparation of materials to improve local administrators' skills in curriculum management and instructor leadership for their teachers, and (4) preparation of support and staff development modules for teachers implementing the individualized instruction approach. Four major products were developed: Curriculum Management System Handbook for supervisors and administrators (ED 182 486); Curriculum Management System Handbook, State Level (ED 182 485); four teacher's guides; and an individualized health occupations program. The state level CMS handbook suggests a CMS developed around five basic functions: management, development, reproduction, diffusion/dissemination, and evaluation/revision. In addition to outlining a CMS method for the local level, the vocational administrator's handbook contains a task listing, classroom/lab budget planning, model, workforce data analysis, and student and employer followup. Teaching guides were developed for transportation, construction, auto body repair, and machine shop programs using a three-volume format. (A copy of a unit from the individualized Health Occupations-Teachers Education program is appended.)

EJ164200

**Dynamic Information Systems in an Educational Environment**

Mellor, Warren L.

Educational Administration Quarterly, 13, 2, 92-107 Spr 1977 (Reprint: UMI)

Describes one attempt to determine the information needs of the administrative users of an information system and to gauge the extent to which that system is meeting the needs expressed.

EJ238772

**Evaluation in Special Education: A Computer-Based Approach.**

Killen, James R.; Myklebust, Helmer R.

Journal of Learning Disabilities, v13 n8 p440-44 Oct 1980

Advantages of computer based evaluation approaches for handicapped students are noted and implementation factors are discussed. The computer network for special education at the DuPage/West Cook Regional Special Education Association in Lombard, Illinois is described.

EJ173513

**Human Resource Information System**

Swinford, Paul

School Business Affairs, 44, 2, 42 Feb 1978 (Reprint: UMI)

A computer at Valley View Schools, Illinois, is used to collect, store, maintain, and retrieve information about a school district's human resources. The system was designed to increase the efficiency and thoroughness of personnel and payroll record keeping, and reporting functions.

ED199527

**ISSOE: Managing Student Progress. Field Test. Phase 1, Final Report.**

Cornell Univ., Ithaca, N.Y. Inst. for Research and Development in Occupational Education.

Dec 1980 90p.; For related documents see ED 199 517.

Sponsoring Agency: New York State Education Dept., Albany. Div. of Occupational Education Supervision.

EDRS Price - MF01/PC04 Plus Postage.

During the last five years, the Instructional Support System for Occupational Education (ISSOE) in New York State has grown to involve approximately 3,000 teachers in development activities. To manage this system, a management information system was set up to develop reports on student progress, student decision making, and planning for student programs. Guides for teachers and administrators were prepared for each of these areas, as well as a guide providing an overall view of the system. A field test was conducted for six months in order to see how well the various components of the system were functioning. The majority of the field test was evaluated by descriptive comments and talks with teachers and administrators in the field. In addition, student

questionnaires were administered. In general, results of the field test showed that the system was working well, and all who were involved with it felt that it was a positive effort. The five recommendations made were primarily concerned with expanding capabilities of assessment through computerization.

ED172995

**A Management and Information System for the Dine Teacher Corps Program "78".**

Wilson, Roger; Salas, Dennis

Northern Arizona Univ., Flagstaff.

Dec 1978 45p.; Document prepared by the Dine Teacher Corps Project

Sponsoring Agency: Office of Education (DHEW), Washington, D.C.

EDRS Price - MF01/PC02 Plus Postage.

The overall objective of the Dine Teacher Corps Project is to demonstrate the effectiveness of an interdisciplinary approach to the development and implementation of a bilingual/multicultural training and inservice training program for educators who will be cognizant of and responsive to the unique educational needs of the Indian child. The five year project, begun in 1978, is designed as a cooperative program between Northern Arizona University, Dine Teacher Corps, and two Bureau of Indian Affairs Navajo boarding schools (Kaibeto and Leupp). In order to perform the three phases of activities required by the project (planning, training programs, demonstration and dissemination), a Management Information System (MIS) has been developed and implemented to provide adequate, accurate, and timely information for decision making, reporting accomplishment, and using resources effectively. The MIS is an integrated information system comprised of seven subsystems: finance, school communities, management, facilities and equipment, personnel, students, and instructional programs. Diagrams, flow charts, models, and tables illustrate details of the MIS program design.

ED194687

**Michigan Occupational Information System Final Evaluation Report.**

Gordon, Eric M.; And Others

Instructional Development and Evaluation Associates, Inc., Berkeley, Mich.

Mar 1980 241p.; For a related document see ED 142 858.

Sponsoring Agency: Michigan Occupational Information Coordinating Committee.

EDRS Price - MF01/PC10 Plus Postage.

An evaluation of the Michigan Occupational Information System (MOIS) was conducted. (The MOIS is a system designed to provide reliable and current career information organized in a readily accessible system for individuals involved in career exploration and decision making.) Three types of survey instruments (site, staff, and client surveys) were designed by a private evaluation agency and the MOIS Evaluation Advisory Committee to obtain information on reasons for using MOIS, the perceived and actual career information needs of clients, and staff and client overall rating of MOIS. Surveys were administered to staff and clients at 364 sites including libraries; elementary, secondary, and postsecondary schools; and vocational rehabilitation offices. Both staff and client survey respondents indicated that MOIS fulfills its intended purpose and is meeting the career information needs of its clients. Respondents indicated a need for the following: updating MOIS information early in the school year, increased promotion of MOIS services, MOIS application training workshops, assessment of the reading level of MOIS material, devising a method by which agencies are made aware of information within MOIS that is relevant specifically to them, and evaluation of MOIS sites. (An executive summary precedes the evaluation report; and an overview of the evaluation workplan and copies of the survey instruments are appended.)

EJ238591

**A Multi-Materials Approach for the Management Information Systems Course.**

McLeod, Raymond G., Jr.; Jones, Jack W.

AEDS Journal, v14 n1 p16-29 Fall 1980 (Reprint: UMI)

Describes a management information course developed at Texas Christian University. The course includes a set of classroom-proven materials that provide students with several options for hands-on involvement--cases and case solution techniques, both small and large decision support systems, and formats for field projects.

ED196624

**NRP Management Information System.**

Del Buono, Lorraine; And Others

Murray State Univ., Ky. Center for Innovation and Development.

Sep 1979 48p.; For a related document, see ED 182 085.

EDRS Price - MF01/PC02 Plus Postage.

A major goal of the National Rural Project's (NRP) Management Information System (MIS) is to aid the parents and educators of rural handicapped students in delivering quality educational services and fully implementing the Education for All Handicapped Children Act, PL 94-142. MIS tailors reports to the specific needs of three target audiences outside NRP: educational agencies (especially Local Education Agencies), colleges and universities, and parents. To obtain information, external users complete one of two NRP Requestor Forms. Five types of reports are available: resource consultants listings, annotated bibliographies, current problems and practices, strategy profiles, and models of pre- and in-services training. Eight simulated reports of all types are included.

ED155796

**A Study of the Availability, Use and Impact of Computers in the Administration of Schools and School Districts. Executive Summary.**

Hansen, Thomas; And Others

Minnesota Educational Computing Consortium, St. Paul.

Nov 1977 15p.

Sponsoring Agency: National Inst. of Education (DHEW), Washington, D.C.

EDRS Price - MF01/PC01 Plus Postage.

In an effort to shed light on the questions surrounding the use and impact of computer-based information systems, the Special Projects Division of the Minnesota Educational Computing Consortium undertook a field-based study of a computer-based information system that can process and produce information dealing with students, curriculum, personnel, facilities/equipment/supplies, and finances. The system is made available through Total Information for Educational Systems (TIES), a cooperative developed and operated by 50 school districts in Minnesota. In-depth interviews were held with 134 employees in eleven of the 50 districts. The employees perform a wide variety of functions categorized as dealing with strategic planning, management control, and operations control. The pervasiveness of the more observable and tangible benefits (time savings, more accurate and timely data, the capability to schedule classes more flexibly, the capability to decentralize budgetary development and control, and easier reporting to external agencies) and the potential for realizing the more

intangible benefits (better decision-making, better long-range planning, more effective resource management, more time to work with people, and better educated students) lead to the conclusion that the investment of time and money in a computer-based information system yields very worthwhile returns.

EJ232503

**Using a Decision Support System in Management Education.**

King, William R.; Rodriguez, Jaime I.

Computers and Education, v4 n3 p167-75 1980

An innovative management decision support system was developed as an integral element of an MBA program. An evaluation of impacts on user attitudes, values, information usage, and decision-making behavior indicated that, although attitudes and values were affected, a positive impact on decision performance quality was not demonstrated.

## Other

EJ234874

**Computers Helping Caseworkers: Decision Support Systems.**

Schoech, Dick; Schkade, Lawrence L.

Child Welfare, v59 n9 p566-75 Nov 1980

Describes a computer-based decision support system for child welfare workers and provides a hypothetical example of computer use by a caseworker. Indicates ways caseworkers should become involved in the design of computer programs for agency records.

ED180017

**Emerging Information Societies in an Interdependent World.**

Bernasconi, F. A.

Sep 1979 8p.; Paper presented at the Annual Meeting of the International Institute of Communications (London, England, September 9-13, 1979)

EDRS Price - MF01 Plus Postage. PC Not Available from EDRS.

Commenting on the trends toward the interlocking of emerging information societies and the growing interdependence of countries, this paper suggests the role that "informatics" (the rational and systematic use of information for planning and decision making) may

play in the transition of societies into the information age. Two paradoxes challenging the builders of information societies are identified: countries must mold their own particular social situations in a context of wide international commitments, and countries involved in international cooperation agreements must also maintain their diversity. Suggestions for meeting the challenge include changing the basis for measuring the development of emerging countries from gross national product, literacy, or personal income criteria to how well the countries manage and apply their information sources, and developing systems of national information resource management. The role of information in emerging information societies is outlined, including the results of the Intergovernmental Conference on Strategies and Policies for Informatics (SPIN) and an Intergovernmental Bureau for Informatics (IBI) survey on international informatics. The role of IBI is defined, and the paper concludes with a call for collaboration between IBI and the International Institute of Communications. A table of characteristics of ten newly industrialized countries is appended.

ED190149

**An Intelligent Support System for Energy Resources in the United States.**

Rosenberg, S.

California Univ., Berkeley. Lawrence Berkeley Lab.

Apr 1980 10p.; For related document, see ED 190 146.

Sponsoring Agency: Department of Energy, Washington, D.C.

EDRS Price - MF01/PC01 Plus Postage.

Based on artificial intelligence research, the frame based system for reasoning described in this paper is one of the components of an intelligent decision support system for an information system on petroleum resources and use which is being designed by the Information Methodology Research Project as the first step in the development of a comprehensive intelligent information system for dealing with energy resources in the United States. By extending the notion of frames to include rule frames which can then be interpreted and applied, expertise of various kinds can be directly encoded into the frame representation. Frame based rules are useful in encoding constraints, performing actions, noticing

complex situations, and deducing solutions. By varying the interpretation of a rule frame, the same competence knowledge can be used in performing each of these tasks. Rules are able to use frame based representation in finding other rules, avoiding most pattern-directed invocation.

ED168568

**Non-Procedural Languages for Information Resource Management.**

Bearley, William L.

30 Jan 1979 19p.; Paper presented at the International Meeting of Exchange (January 30, 1979)

The future of information resources management requires new approaches to implementing systems which will include a type of data base management that frees users to solve data processing problems logically by telling the system what they want, together with powerful non-procedural languages that will permit communication in simple, concise statements without complex data descriptions or program logic. A communication gap between the end-user and computer caused primarily by inadequacies of traditional programming approaches and methods of managing files may be remedied by the use of such non-procedural languages. The non-procedural language-base approach provides a "user-friendly" interface between user and computer that does not require knowledge of a data processing language or of data base structure. Decreased cost, increased productivity, and increased system availability to users are significant implications. The Information Resource Management System (IRMS), a non-procedural approach, is applicable for all internal organizational information processing, as a powerful development language for new applications, and as a utility for handling ad hoc requests or for one-time applications. The system focuses on the data, which are accessed through a data base manager. Generalized processing functions are accessed through a command language useable in both a batch and time-sharing environment, and a procedural language interface accommodates users with special processing needs.

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